
Space Weather Technical Forecast

Issued on Friday, 16 February 2024 at 01:28 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Isolated M-flares likely and a slight chance X-flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate, with one M1.8 at 15/1707UTC emanating from AR3576 which is approaching the southwest limb. This flare appeared to be associated with a CME, but imagery is currently inconclusive. No further significant flare activity has been observed. AR3576 is one of ten regions on the visible disc. AR3582 is fading and simplifying, while AR3583 has increased in complexity, with the development of intermediate spots, although this has not resulted in increased activity. Several benign or stable regions are dotted around the disc, with a number of new regions in the eastern hemisphere. These will be monitored for further developments. No Earth-directed CMEs were observed in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds as observed L1 initially showed evidence of a magnetic cloud following a weak CME arrival late on 14 February. Solar wind speeds followed a rising trend, reaching a peak of between 450-500km/s. Density started above average, but decline to average levels. Total magnetic field strength started at moderate levels but quickly weakened through the period. The north-south component, Bz, varied weakly throughout. Phi angle started negative (towards the Sun) but rotated into a positive orientation from 15/0700UTC. Geomagnetic activity was Quiet (Kp 0 to 1).

Energetic Particles / Solar Radiation: GOES18 high energy (greater than 10MeV) proton flux has been below the S1/Minor Storm threshold throughout and after a steady decline, has begun to level out, averaging close to 3 or 4 pfu. Electron flux (greater than 2MeV) has been at background, with electron fluence well below the Active (1e8 integrated pfu) threshold. The observed fluence at 15/0000UTC was 1.48e6 pfu.

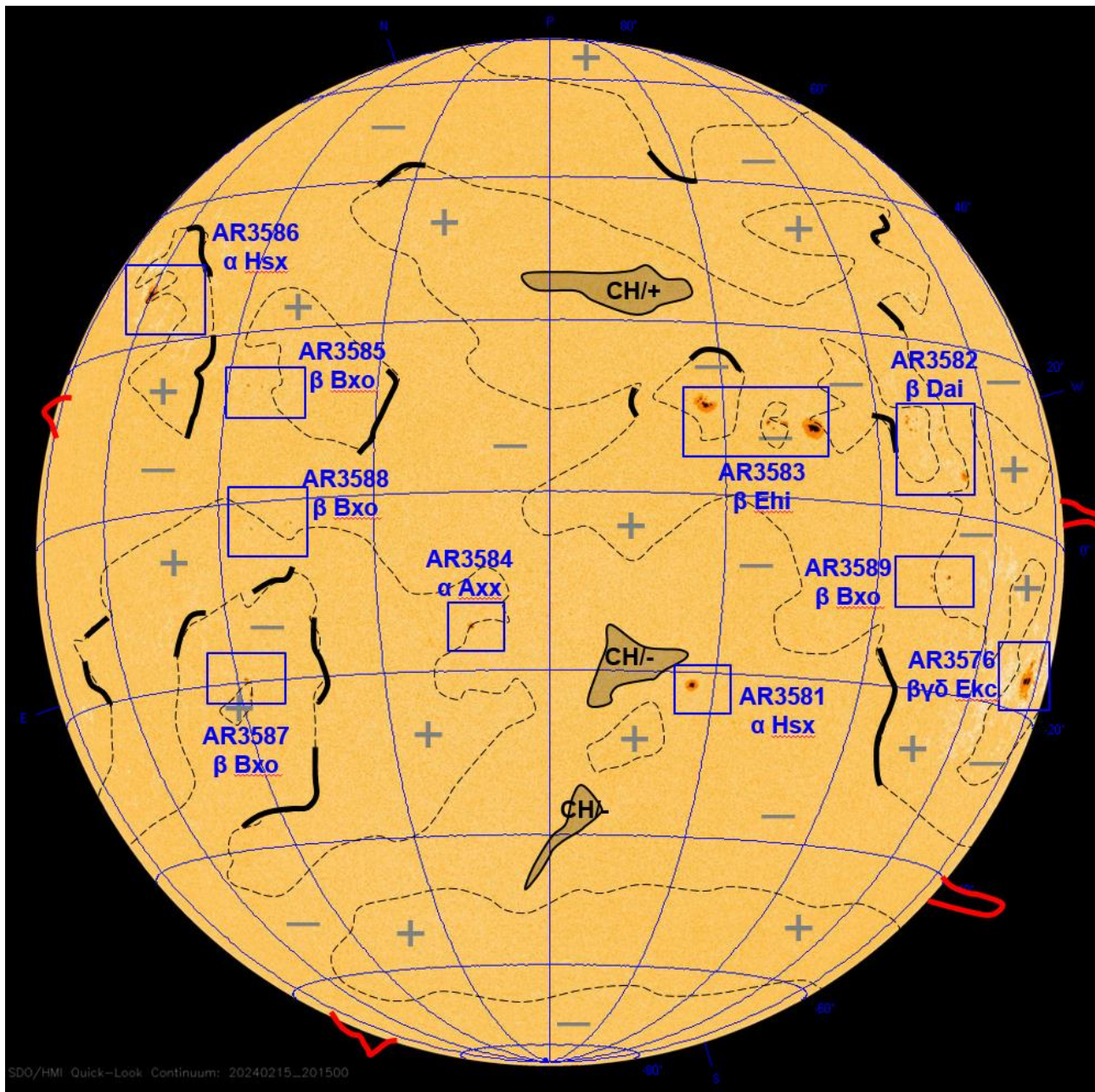
Four-Day Space Weather Forecast Summary

Solar Activity: Low activity is expected with a likelihood of M-class flares and a continued low risk of X-class flaring.

Solar Wind / Geomagnetic Activity: No Earth directed CMEs are forecast. Solar winds are at slightly elevated levels, and are expected to decline towards ambient levels through the next four days. No coronal hole enhancements are expected, with all possible sources appearing weak. Mainly Quiet activity is expected.

Energetic Particles / Solar Radiation: GOES18 high energy (greater than 10MeV) proton flux is forecast to continue to decline towards background levels in the absence of any further sources of radiation storms, although AR3576 still presents a limited risk. High energy electron flux (greater than 2MeV) is expected to remain at background. The associated 24-hour electron fluence is expected to stay below the Active threshold.

Figure 1. Solar Analysis Valid 15/2000 UTC.



Key: Filament ____, Prominence ____, Magnetic Field Line - - -, Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

No Earth-directed CMEs are in the forecast. A large farsided eruption was observed early on 15 February. A further eruption from the vicinity of AR3576 appears to be emerging on LASCO 2 imagery, but not sufficient for any detailed analysis at present. However based on the available imagery it is considered unlikely to affect the Earth. A weak CME appears to have arrived at Earth late on 14 February, with the effects of this already having waned.

No significant coronal holes are visible on the Earth-facing disc, with three weak coronal holes all weak and relatively small. Based on this and in the absence of any CMEs, solar wind speeds are expected to slowly decrease from slightly elevated to background levels.

Mainly Quiet geomagnetic activity throughout the period.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Figure 2: 24 hour L1 solar wind observations



Radio Blackouts - X-Ray Flares:

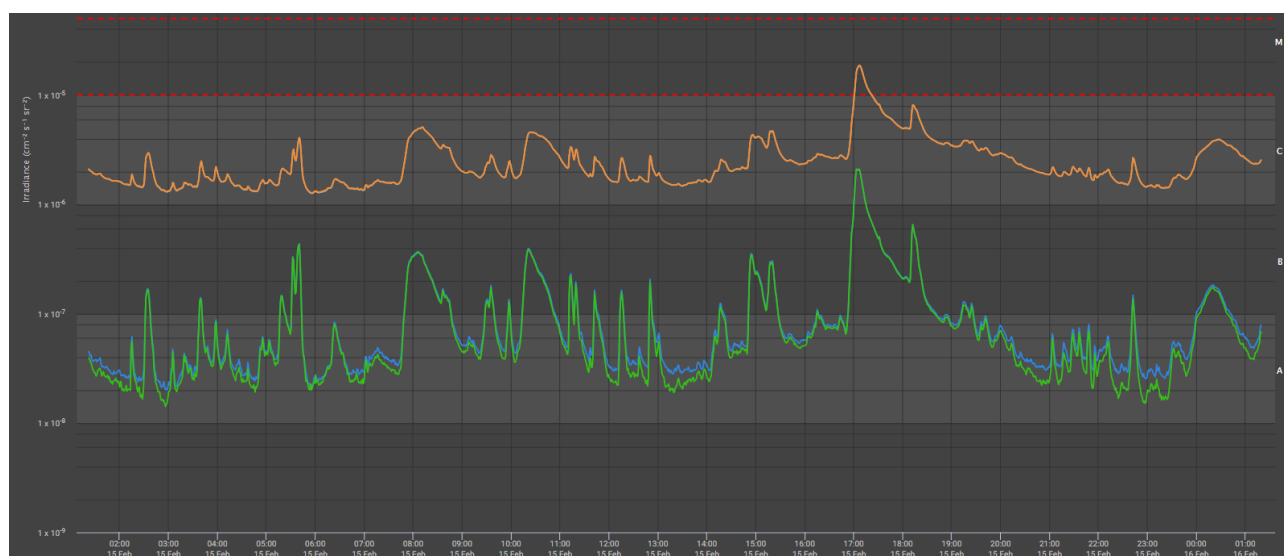
Low, with occasional Moderate activity is expected through the next four days, with isolated M-class flares and a low risk of X-class flaring.

AR3576 is a mature but complex region which is approaching the southwest limb. This has produced a recent M-class flare, but overall activity from this region has declined over the last few days. AR3583 has been increasing in complexity through the last 24 hours, with the emergence of some intermediate spots, although this has not yet translated into increased activity. AR3582 is weakening and may fade before reaching the western limb. A number of weak regions are developing in the eastern hemisphere, and will be monitored for further developments. All the other regions are either stable or weak.

Due to the AR3582 fading and AR3576 rotating towards the southwestern limb, a declining trend in flare risk is forecast through the forecast period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	70	70	60	50
Very Active	R3 to R5 X Class	No	15	15	10	10

Figure 3: GOES 16 X-ray flux



Solar Radiation Storms - (High Energy Protons):

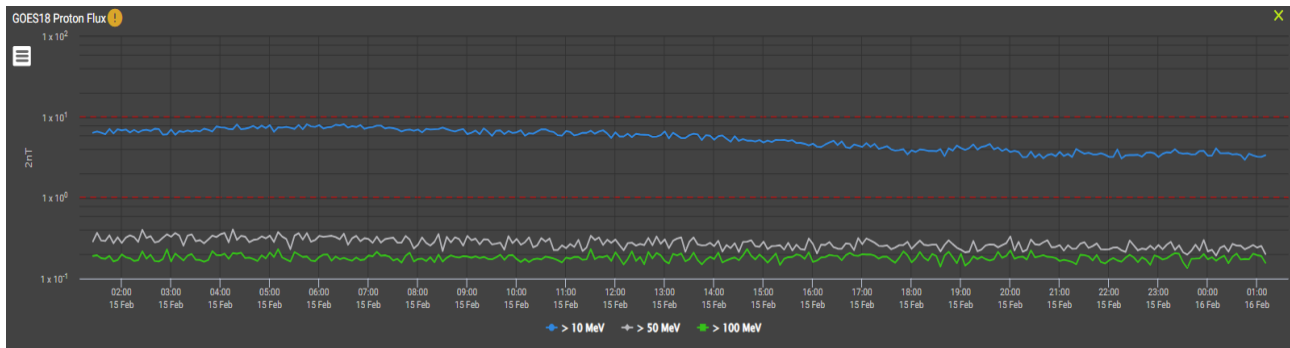
GOES 18 high energy (greater than 10MeV) protons has levelled out after following a steadily declining trend through the last 24 hours. Proton flux is expected to continue slowly declining through the period in the absence of further significant flare activity.

There is a risk of further enhancements, especially from AR3576 and increasingly from AR3583 which is becoming increasingly complex. Both these regions are in the western hemisphere which is prime location for an Earth-connection from any proton rich flare eruption. The flare risk declines later in the period as AR3576 rotates off the visible disc.

Radiation Storms	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{s}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq \text{S1}$	Yes	30	25	20	10
Very Active	$\geq \text{S3}$ *	No	1	1	1	1

* S3 $\geq 10 \text{ MeV} \geq 1000 \text{ pfu}$ and / or $\geq 50 \text{ MeV} \geq 10 \text{ pfu}$. (pfu = $\text{cm}^{-2}\text{sr}^{-1}\text{s}^{-1}$)

Figure 4: GOES18 Proton Flux



High Energy Electrons Event ($\geq 2\text{MeV}$):

High energy electron flux (greater than 2MeV) at GOES16 is expected to remain at background level, with no notable inputs into the radiation belts.

24-hour fluence values are expected to continue to track at background levels, based on the lack of inputs into the radiation belts.

GEO Electron Environment	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^8$	No	1	1	1	5
Very Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^9$	No	1	1	1	1